DOCUMENT RESUME

ED 166 258 TM 008 334

AUTHOR Hiscox, Suzanne B.; Owen, Thomas R.
TITLE Behind the Basic Assumption of Model A.
PUB DATE [Mar 78]
NOTE 32p.; Paper presented at the Annual Meeting of the American Educational Research Assoication (62nd, Toronto, Ontario, Canada, March 27-31, 1978)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Academic Achievement; Achievement Tests; Attrition (Research Studies); Compensatory Education Programs; Educational Assessment; Elementary Education; *Evaluation Methods; *Longitudinal Studies; Models; *Norm Referenced Tests; *Norms; Program Evaluation; Research Design; Sampling; *Statistical Bias
IDENTIFIERS Elementary Secondary Education Act Title I; *Regression Effects; *RMC Models

ABSTRACT

This study explored the assumption that the percentile rank of a group of students should be expected to remain the same on a post-test as on a pretest when the treatment of the group in the intervening period was the same as the treatment of the norms population. This assumption is basic to the use of the norm-referenced model for the assessment of Elementary Secondary Education Act Title I programs. Among the effects which may weaken the usefulness of the assumption are sampling errors, floor effects, out-of-level testing effects, selective drop out, poor match between the curriculum and test content, and regression effects. In this study, longitudinal data were studied for up to four years for Portland, Oregon, public school students selected to be below certain specified pretest percentiles. The differences from one year to another range from zero to nine percentiles. This variation may well be large enough to overshadow Title I effects. (Author/CTM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

AERA Session 29.07

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

BEHIND THE BASIC ASSUMPTION OF MODEL A*

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Suzanne Hiscox

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

Suzanne B. Hiscox
Northwest Regional Educational Laboratory

Thomas R. Owen
Educational Consultant, Portland, Oregon

ED166258

TM008 334

Three evaluation models--the norm-referenced model, the control group model and the regression model--have been proposed as a potential means to gather standard comparable data on the effect of Title I projects across the United States. This paper deals with the norm-referenced model, Model A. The norm-referenced model, designed for schools lacking enough students for a comparison group to the Title I project, is expected to be used by a majority of the school districts in the country. Of the three proposed evaluation models, Model A also is based upon the most assumptions associated with the definition of a treatment effect.

The major assumption behind Model A states that a group of Title I students scoring at a given percentile rank on a pretest would also score at that percentile rank on a posttest if they did not receive Title I services. Title I services, then, are expected to move the group from its pretest percentile level to another, higher percentile level by the time the posttest is given. When a nationally-normed test is used for the evaluation, project impact--or the treatment effect--is calculated by subtracting the normal curve equivalent (NCE) for the percentile rank corresponding to the group mean pretest scores from the NCE for the percentile of the mean posttest score.

*The authors would like to thank Area I of Portland Public Schools for permission to use their longitudinal data bank, and the Portland Public Schools Data Processing Department --in particular Mr. Robert Petchell, who extracted the data from the tape files for us.

This assumption of percentile rank maintenance (also called the equipercentile assumption) has generated a fair amount of literature concerning its acceptability. On the face of it, the assumption that Title I students would remain at a given percentile level seems intuitively appealing. But the adequacy of the equipercentile assumption is, as they say, an empirical question.

A number of studies already reflect upon the equipercentile assumption. Two studies conducted prior to the 1965 influx of Federal compensatory education money offer data bases free of large-scale programmatic confounding. Coleman et al. (1966) conducted an extensive survey of educational achievement and opportunities for American students. As part of the survey, the reading and math components of the Sequential Tests of Educational Progress were administered to third, sixth, ninth and twelfth graders throughout the country. After developing standard scores (with a mean of 50 and standard deviation of 10) for each test and level administered, the researchers compared the achievement of different ethnic and regional subgroups in grades 6, 9 and 12. Using the white, metropolitan, Northeast subgroup as a comparison, they computed the number of standard deviation units that different subgroups scored below the comparison group. Subgroups scored from 0 to 1.6 standard deviations below the comparison group in reading, and from 0 to 1.5 standard deviations below the comparison group in math.

The question of interest, however, is not the relative standing of the various subgroups, but rather the stability of the standing. Relative achievement gains or losses of the 19 subgroups are presented in Table 1. It can be seen that about two-thirds of the subgroups moved at least .1 standard deviation units (2.1 NCE's) from one grade to another. The number of subgroups moving .2 or more standard deviation units (4.2 NCE's) varied by grade range and topic.

Do these data indicate such instability as to argue against the equipercentile assumption? On the surface it might appear so, but the survey was cross-sectional rather than longitudinal and subgroups were compared to the highest-scoring group rather than the national average. These design aspects preclude the inference that the apparent subgroup movements would appear in longitudinal data. Even if longitudinal data reflected such movement, the use of national norms might reduce the size of the movement for subgroups to an insignificant amount. It is apparent from the data, however, that different subgroups of the national population follow different trends in their scores on achievement tests. The data also point out different trends in reading and math achievement.

In a second study using pre-Title I data, Mayeske and Beaton (1975) examined cross-sectional data to determine the percent of minority students scoring above scores representing selected percentile ranks for white students in grades 6, 9 and 12. As the authors examined progressively higher grades, smaller percentages of minority students achieved at the selected percentile ranks. Use of regression equations including home background, family and socio-economic status appreciably raised the percentages, however. As in the Coleman study, the use of cross-sectional data weakened the design for examining the equipercentile assumption. Given the possible differences among students at different grade levels in the sample, and possible effects due to potential dropouts and other potential differences in the type of students included in the groups, the data cannot be used to effectively argue against the adequacy of the equipercentile assumption. If similar results were found with longitudinal data, however, they would indicate a serious problem with the assumption.

Recent studies more directly address the equipercentile assumption. Armor et al. (1976) studied 20 schools showing substantial or consistent gains in median sixth-grade

percentile ranks in reading between 1972 and 1975. A longitudinal study of students in these schools examined the percentile rank of the students' average raw scores on reading tests from the Cooperative Primary Tests and the Comprehensive Tests of Basic Skills. The data showed a percentile gain from the third to the fourth grade, then decreases from the 33rd percentile to the 29th percentile (2.4 NCE's) from grades 4 through 6. While it is impossible to know exactly what programs the students received, and the size of the study was small, the evident movement in percentile ranks argues against the equipercentile assumption.

Kaskowitz and Norwood (1977) used data from several sources to compare plots of empirical student achievement with a plot of scores expected on the basis of the equipercentile assumption. They found that very low-achieving students achieved higher than expected through equipercentile assumption, although this phenomenon could possibly be explained by floor effects, or chance scoring. As the authors indicated, out-of-level testing might eliminate the problem with extremely low scores. After examining longitudinal data within grades, the authors concluded that, with the exception of extreme pretest scores, the equipercentile model appeared adequate for predicting spring achievement from fall achievement. Linn (1978) computed NCE fall-to-spring differences for the same sample (comprised of second through eighth graders with both spring and fall test scores during the fall norming of the Metropolitan Achievement Test). He found NCE differences ranging from -1.2 to 5.5 NCE's on math items, and from -.2 to 2.9 NCE's on reading items. For only two grades--seventh graders in reading and second graders in math--did the difference exceed 2.1 NCE's, or .1 standard deviations. Given the size of the sample, most of the differences found are statistically significant, but the practical significance of the differences may or may not be great.

Kaskowitz and Norwood (1977) also examined data from comparison groups to a follow-through study and treatment and comparison group students in a compensatory reading study. While their data showed both percentile gains and drops for the groups from pretest to posttest, the results among the groups and subgroups were not consistent in size or direction. While the data may not support the equipercentile model, they provide little direction for development of an alternative model.

The data from the above studies is inconclusive in terms of the equipercentile assumption. In most studies of the assumption, the data will probably be subject to numerous interpretations. Part of the reason for continuing ambiguity is the number of factors which can affect the accuracy of the assumption. These factors have already been discussed by a number of people. RMC Research Corporation, the developers of the proposed model, have already presented qualifications which affect the accuracy of the maintenance prediction. Tallmadge and Wood (1975) point out that the assumption is only as good as the norm group for the test. If students are compared against a norm group which is not similar in many respects to themselves, then equipercentile predictions will contain considerable error. Anderson (1978) discusses some aspects of norms which should be considered.

There is a second qualification of the equipercentile assumption which can cause grave problems in using Model A at the high school level. As students--especially low-scoring students--drop out of high school, the score needed to achieve a given percentile level from one testing time to another will increase. Thus, Title I high school students could be compared with norm groups containing relatively fewer low-scoring students.

Other potential problems with the percentile maintenance assumption deal with the way in which publishers establish their norms. Kaskowitz and Norwood (1977) discuss

the use of cross-sectional rather than longitudinal groups of students in developing test norms and potential problems in the articulation between levels of a test battery as problems which affect the equipercentile assumption. The smoothing of growth curves by test publishers as they establish norms may also present problems. In the smoothing process, variations which may represent real growth among students are lost--at some grades, growth may be underestimated, and at other grades overestimated, by the smoothing process.

Out-of-level testing may also threaten the validity of the equipercentile assumption. Pelavin and Barker (1976) studied the effects of out-of-level testing using the Metropolitan Achievement Test in grades 4 through 6. They found a number of problems in out-of-level testing which they attributed to the standard score scale, possibly ceiling and floor effects. In general, they found that testing with two different levels of a test battery produced different standard scores (and thus percentile ranks). On the other hand, Kaskowitz and Norwood (1977) found problems in the equipercentile assumption which may have been due to floor and ceiling effects--the basic reason for testing out-of-level.

A further potential problem with the equipercentile assumption occurs in the selection of tests. If tests are used which fail to sample adequately the curriculum of the school as a whole, or which contain elements not taught in the curriculum, students at that school may not show enough achievement on the test to maintain their percentile rank. However, most nationally-normed achievement tests are designed to cover basic content throughout the country, so this problem should be minimal.

A final argument against the equipercentile assumption relates to the fact that the assumption involves prediction of a posttest score from a pretest score. It is generally acknowledged that two types of regression can occur in an evaluation design (Minium, 1970).

One type particularly relevant to Title I evaluations occurs when a treatment group is selected on the basis of low scores or ratings which are subsequently used as a pretest measurement. In general, the pretest measurements will contain larger than normal amounts of negative error which will cause any treatment effects to appear larger than they really are. This type of regression is substantially controlled in Model A by an implementation guideline calling for separate pretest and selection measures.

A second type of regression problem, based on the predictive nature of the equipercentile assumption, is not controlled for in the design. Given a population measured on a specific variable and a sample selected from the population, the best prediction of the sample's mean measurement at a second point in time is not the sample mean but, rather, the sample mean (in standard deviation units) multiplied by the test-retest reliability of the measurement instrument. This type of regression will exist despite the separation of pretest and selection measures. The magnitude of this type of regression in Title I evaluations determines its effect on the equipercentile assumption --and, as of yet, the magnitude is not known. Murray (paper in preparation) has examined this regression problem in Model A and made suggestions to account for the continuing regression problem.

STUDY DESIGN

Basic Questions

This study was designed to examine the equipercentile assumption using longitudinal data available from the Portland Public Schools. In the study, we examined the percentile standings of Title I and non-Title I eligible students from ten public schools in Portland. We determined the sequential percentile standing of groups of students who were Title I-eligible for zero to four years over a four-year period of time. We also

examined the sequential standing, over a three- to four-year period, of Title I and non-Title I eligible students scoring below the 5th, 15th, 25th and 35th percentile on the California Test of Basic Skills administered in the spring of 1974. Specific questions which the study was intended to answer included:

(1) Did Title I students show greater than zero NCE gains over a school year? (If negative NCE gains were found, they might provide evidence for questioning the Model A assumption of percentile level maintenance among the students.)

(2) Did non-Title I students with low percentile standing in Title I and non-Title I schools maintain a constant percentile level?

School District Information

Area I of Portland Public Schools maintains several kinds of information which allowed for a longitudinal study of student achievement. Records of student scores on yearly administrations of the California Test of Basic Skills (CTBS) are kept on file. (Tests were administered at a functional level.) The data from 1973 to 1977 were available for all students in Area I of the district. Also, a districtwide compilation was available which gave the relative achievement levels of all schools in the district, as well as comparative ethnic and socio-economic data.

School Selection and Description

This study followed fourth and seventh grade students in selected elementary schools. Ten schools in the district were selected for the study, using the following criteria:

(1) All K through 8 elementary schools which had Title I students were selected.

(2) The next two lowest-scoring non-Title I K through 8 elementary schools were chosen.

The schools are more completely described in Table 2.

Study Procedures

In this study, students' achievement test scores were followed for a four-year period. Students in the fourth and seventh grades in 1973-74 were used in the study. (Only students for whom data were available for at least three of the four years were used in the study.) In all, 419 students were followed from grades 4 through 7, and 327 students were followed from grades 7 through 10. The students were divided into four groups on the basis of percentile rank:

(1) Those scoring at or below the 5th percentile

(2) Those at or below the 15th percentile

(3) Those at or below the 25th percentile

(4) Those at or below the 35th percentile

Obviously, students in groups with a given percentile cutoff would also be in groups with higher percentile rank cutoffs.

For each percentile cutoff, the students who met that criteria in the spring of 1974 were determined. These students were then followed as a group and their average standard score was computed for the following years for which there were data on the students. This standard score was then converted to a percentile rank and was shown in the analysis as the average rank of the students at or below a given percentile level.

An additional aspect of the study considered the length of time during which students were Title I-eligible; that is, they achieved only 75 percent of their expected

grade equivalent score on the CTBS. Over the four years examined in this study, students could be eligible for Title I from zero to four of the years. Students were grouped on the basis of their number of years of eligibility, and the average expanded scores and corresponding percentiles for each group were plotted from 1974 through 1977.

Problems With This Study

A major problem in this study was the drop-off in terms of the students having data for the fourth year of this study. In the elementary school, about a third of the students were lost by the time the fourth year data were analyzed. In the high school, more than two-thirds of the students were lost by the time the fourth year data were analyzed. Examination of the representativeness of the data was conducted by plotting the mean expanded standard scores for the groups over the four-year period. Instead of the normal negatively accelerating curve common when plotting achievement growth in terms of expanded standard scores, we found that that curve could be applied only to the first three years.

On the whole, the fourth-year achievement was much higher than the third-year achievement, and the curve would start to accelerate sharply again. Therefore, especially for the high schools, we determined that the fourth-year data were not representative of the students involved in this study for the first three years. While results are reported, we suggest they not be considered in looking for trends. One reason for the sharp decline in numbers of students with tenth grade data is the fact that, except for Title I testing, Area I of Portland Public Schools conducts testing only through the first nine grades. Only two of the five high schools had Title I students, and only one of those two tested extended their testing to non-Title I students.

A second potential problem with this study involves the widespread use of out-of-level testing in the Portland testing program. Table 3 shows the percent of students tested at each grade level with each of five levels of the CTBS. The decision to test students out-of-level was made upon unknown criterion and, as we have cited earlier in this study, the effects of out-of-level testing upon the expanded standard score received by students is not consistent and is not really known at this time.

RESULTS AND DISCUSSION

Percentile Levels of Group at Selected Levels

Tables 4 through 7 show the percentile ranks of students scoring below the 5th, 15th, 25th and 35th percentile on the spring 1974 CTBS administration (see Table 12 for cutoff scores). Students were also grouped in terms of the number of years out of the four they were eligible for Title I services. Although the same students were followed over a four-year period, the different "N's" in the table reflect missing data on the students. When examining the tables, the size of the N's should be considered.

Almost all of the groups examined showed gains from 1974 to 1975. These gains could reflect regression effects. While many of the groups show fairly consistent percentiles, others show enough change over the last three years to cause problems with an evaluation based on an assumption of percentile maintenance. It is difficult to tell whether the variability is due to real differences in student achievement, changes in test levels administered over the four years, or the amount of incomplete data involved in this study. It should be noted that students eligible for Title I over longer periods of time do not show consistent raises in their percentile levels, as would be expected under Model A. On the other hand, those students who show continued low achievement will tend to be retained in Title I programs.

Percentile Profiles for Students with Different Years of Title I Eligibility

In a further attempt to examine the growth of students receiving and not receiving Title I services, the average expanded standard scores and percentile ranks were tracked for groups of students eligible for Title I during the four years of the study. The results of the tracking are included in Tables 8 through 11 and are profiled in Figures 1 through 4 of Appendix A. (In Appendix A, numbers from 0 to 4 are used to indicate years of eligibility.) On the whole, these tables do not show a great deal of variability in percentile rank from year to year. The differences from one year to another range from zero to nine percentiles, with the majority of the differences between years ranging from two to three percentiles. While this variation does not seem overly large, it may well be large enough to overshadow Title I effects, especially at the high school level. Thus, even these results are not particularly promising if they indicate that the "noise" level in a Model A study is greater than the potential student gains. There is little evidence here to suggest that either Title I students or comparable low-scoring non-Title I students might show percentile declines.

REFERENCES

Achievement Profiles. Portland Public Schools, Portland, Oregon, 1975.

Armor, D., Conry-Oseguera, P., Cox, M., King, N., McDonnell, L., Pascal, A., Pauly, E., Zellman, G. Analysis of the school preferred reading program in selected Los Angeles minority schools. Report prepared for the Los Angeles Unified School District, Santa Monica, California. RAND Corporation, 1976.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPortland, J., Mood. A.M., Weinfeld, F.D., York, R.L. Equality of educational opportunity, U.S. Department of Health, Education and Welfare, Office of Education. Washington, D.C.: Government Printing Office, 1966.

Kaskowitz, D.H., & Norwood, C.R. A study of the norm-referenced procedure for evaluating project effectiveness as applied in the evaluation of project information packages. Report prepared for USOE under contract OEC-0-74-9256. Menlo Park, California: Stanford Research Institute, 1977.

Linn, R.L. Evaluation of Title I via the RMC models: A critical review. Paper presented at the CSE Invitational Conference on Measurement and Methodology, Center for the Study of Evaluation, UCLA, Los Angeles, January 1978.

Mayeske, G.W., & Beaton, A., Jr. Special studies of our nation's students. Washington, D.C.: Government Printing Office, 1975.

Minium, E.W. Statistical reasoning in psychology and education. New York, New York: John Wiley and Sons, Inc., 1970.

Murray, S.L. Identifying and controlling sources of regression bias in Model A. Portland, Oregon: Northwest Regional Educational Laboratory; in progress.

Pelavin, S., & Barker, P. A study of the generalizability of the results of a standardized achievement test. Paper presented at the American Educational Research Association Meeting, San Francisco, April 1976.

Tallmadge, G.K., & Wood, C.T. User's guide: ESEA Title I evaluation and reporting system. Mountain View, California: RMC Research Corporation, October 1976.

TABLE 1

Subgroup Gains and Losses in Standard Deviation Units

SUBJECT	GRADE RANGES	CHANGE IN STANDARD DEVIATION UNITS									
		+.5	+.4	+.3	+.2	+.1	0	-.1	-.2	-.3	-.4
Reading	6-9				1	2	7	4	4	1	
	9-12					4	6	4	5		
	6-12			1		1	6	5	1	2	3
Math	6-9	1	1	3	5	7	3				
	9-12				1	5	7	6			
	6-12		4	3	6	6					

TABLE 2

School Descriptions

SCHOOL CHARACTERISTICS	SCHOOLS OF ORIGIN									
	A	B	C	D	E	F	G	H	I	J
Title I*	N	Y	Y	N	Y	Y	Y	Y	Y	Y
Ethnic Composition (Percent)										
WHITE	95	81	85	93	92	93	92	71	77	98
BLACK	2	17	10	2	3	3	5	26	20	1
OTHER MINORITY	3	2	5	5	5	4	3	3	3	1
Median Grade Completed for Adults 25 Years and Older (1970 Census)	12	12	13.0	12	12	11	12	12	12	12
Percent of Husband/Wife Families (1970 Census)	87	82	81	89	86	85	86	85	84	86
Median Family Income (1970 Census)	$9,233	$8,266	$12,058	$10,028	$8,748	$8,371	$8,740	$9,416	$9,257	$8,383
Percent of Free Lunches to Average Daily Total Lunches (1974-1975)	29	52	43	34	48	54	50	49	47	56
Percent of Student Mobility (1973-1974)	17	20	16	20	23	22	24	22	19	24
Percentile Standing Among Portland Public Schools for Grade 4										
READING	60	55	80	65	45	20	22	50	23	30
MATH	20	30	80	47	53	13	20	38	25	53

*Y=YES; N=NO

TABLE 3

Percent of Students Taking Different CTBS Levels

GRADE	CTBS LEVEL			
	1	2	3	4
4	49	46	5	
5	29	58	13	
6	15	46	32	7
7	9	25	48	18
7	17	26	35	22
8	9	22	36	33
9	5	26	28	41
10	7	34	39	20

TABLE 4

Reading Total Scores for Lower Grades

Years of Eligibility	Maximum Percentile	Grade	N	$\bar{X}$	S.D.	%ile
0	5	4	14	283.8	21.4	1
		5	11	339.1	37.2	8
		6	13	358.5	33.8	6
		7	13	381.9	34.7	5
	15	4	31	308.1	27.3	7
		5	28	361.5	40.7	12
		6	30	390.5	45.4	12
		7	29	414.4	45.8	10
	25	4	58	331.6	32.7	12
		5	55	387.2	43.5	19
		6	55	416.3	51.4	19
		7	52	439.2	53.5	16
	35	4	80	344.9	35.4	16
		5	77	400.0	44.3	24
		6	76	428.6	55.2	23
		7	72	449.4	53.6	19
1	5	4	23	255.8	44.0	2
		5	19	305.0	62.3	3
		6	22	357.8	48.1	6
		7	17	387.7	49.5	5
	15	4	55	297.2	46.0	5
		5	51	343.7	56.3	8
		6	53	386.4	60.7	11
		7	46	420.6	61.7	11
	25	4	77	314.2	47.5	8
		5	73	357.2	54.3	11
		6	75	398.5	57.5	14
		7	66	431.8	60.5	14
	35	4	95	326.9	50.3	11
		5	91	367.2	54.2	13
		6	93	406.3	55.5	16
		7	83	436.9	56.7	15
2	5	4	18	258.0	42.7	2
		5	15	296.9	63.1	2
		6	18	352.2	45.5	5
		7	15	388.4	50.6	5
	15	4	46	299.6	43.6	5
		5	43	339.0	55.1	8
		6	45	382.6	61.6	10
		7	40	419.4	61.4	11
	25	4	63	315.0	45.4	8
		5	60	351.5	53.5	9
		6	62	393.9	58.9	13
		7	55	428.4	61.0	13
	35	4	75	325.6	48.2	10
		5	72	361.2	55.1	12
		6	74	401.8	58.4	15
		7	66	434.6	59.1	15

TABLE 5

Reading Total Scores for Upper Grades

Years of Eligibility	Maximum Percentile	Grade	N	$\bar{X}$	S.D.	%ile
0	5	7	4	370.0	8.12	4
		8	3	416.7	29.0	7
		9	3	419.7	23.1	4
		10	0	-	-	-
	15	7	10	396.6	26.0	7
		8	9	458.2	47.8	15
		9	7	470.0	52.7	11
		10	1	534.0	-	20
	25	7	24	430.6	34.3	14
		8	23	489.5	50.1	21
		9	19	504.2	49.5	20
		10	3	538.3	44.6	21
	35	7	44	453.5	36.0	21
		8	43	503.1	47.1	29
		9	39	523.5	48.8	26
		10	5	569.4	53.9	32
1	5	7	39	329.5	49.3	0
		8	39	374.1	65.3	3
		9	35	414.2	70.5	3
		10	25	419.5	48.1	3
	15	7	69	365.6	56.3	4
		8	69	405.2	63.8	6
		9	64	444.8	66.2	7
		10	36	434.9	51.9	4
	25	7	104	394.4	61.4	6
		8	104	428.8	64.1	9
		9	98	465.9	65.3	11
		10	53	462.4	61.2	6
	35	7	124	408.2	64.6	9
		8	124	439.0	64.1	11
		9	117	475.1	65.0	12
		10	61	469.2	64.2	7
2	5	7	27	326.9	53.8	1
		8	27	371.8	71.6	3
		9	26	414.7	79.6	3
		10	23	417.9	49.6	2
	15	7	43	356.7	58.3	3
		8	43	396.9	67.3	5
		9	42	438.1	72.2	6
		10	31	429.9	49.7	3
	25	7	63	386.0	64.7	5
		8	63	424.0	70.5	9
		9	61	458.7	71.9	8
		10	43	456.6	62.2	6
	35	7	67	391.5	66.6	6
		8	67	428.1	70.6	9
		9	65	464.2	73.2	10
		10	46	462.5	64.4	6

TABLE 6

Arithmetic Total Scores for Lower Grades

Years of Eligibility	Maximum Percentile	Grade	N	$\bar{X}$	S.D.	%ile
0	5	4	24	296.0	20.0	2
		5	21	348.0	43.0	7
		6	22	372.4	43.1	7
		7	20	393.0	46.3	7
	15	4	55	318.0	24.6	6
		5	52	362.0	38.5	10
		6	53	389.0	46.3	11
		7	48	407.2	47.8	10
	25	4	91	334.0	27.8	10
		5	88	380.0	41.4	16
		6	89	405.4	44.9	15
		7	80	427.1	50.0	15
	35	4	130	346.2	29.9	14
		5	127	391.0	41.1	22
		6	126	416.0	44.8	20
		7	114	346.7	29.5	2
1	5	4	3[illegible]	293.3	21.3	2
		5	34	325.7	39.1	3
		6	34	366.6	49.9	6
		7	30	391.1	38.8	6
	15	4	79	315.4	25.6	5
		5	77	347.6	36.3	7
		6	76	386.4	43.7	10
		7	71	414.6	43.0	12
	25	4	98	323.7	28.5	7
		5	94	353.6	36.3	8
		6	94	392.5	43.3	12
		7	85	415.8	43.2	12
	35	4	106	327.6	30.7	8
		5	102	356.0	37.8	9
		6	102	394.6	44.3	13
		7	93	327.9	30.6	1
2	5	4	31	292.6	20.1	2
		5	30	319.5	32.3	3
		6	30	357.2	44.5	5
		7	27	384.9	34.9	[illegible]
	15	4	68	315.5	25.7	[illegible]
		5	67	344.9	35.5	6
		6	66	383.2	44.3	9
		7	62	412.7	43.3	11
	25	4	79	321.3	28.0	6
		5	77	350.3	36.8	7
		6	77	388.5	44.3	11
		7	70	414.8	42.2	12
	35	4	85	325.2	30.6	7
		5	83	352.4	38.5	8
		6	83	390.7	45.6	10
		7	76	324.8	31.6	1

TABLE 7

Arithmetic Total Scores for Upper Grades

Years of Eligibility	Maximum Percentile	Grade	N	$\bar{X}$	S.D.	%ile
0	5	7	5	352.6	7.5	1
		8	4	404.2	34.4	6
		9	3	403.7	78.0	2
		10	0	–	–	–
	15	7	24	396.1	26.0	7
		8	23	448.5	47.6	14
		9	21	468.5	65.9	11
		10	1	458.0	–	7
	25	7	42	415.7	30.5	12
		8	41	463.5	46.0	19
		9	39	481.1	60.8	14
		10	3	509.0	70.1	15
	35	7	76	438.9	34.6	18
		8	75	484.9	47.2	26
		9	72	509.2	63.6	21
		10	7	543.7	55.4	24
1	5	7	48	346.6	31.9	2
		8	47	373.8	39.8	3
		9	44	400.7	45.5	2
		10	29	402.6	45.3	2
	15	7	86	371.2	37.6	4
		8	85	400.4	52.5	5
		9	81	426.8	50.8	4
		10	48	435.0	60.6	4
	25	7	109	385.8	44.0	6
		8	108	413.3	53.9	7
		9	103	439.7	54.3	6
		10	57	443.7	60.1	5
	35	7	126	396.8	49.5	7
		8	125	421.9	56.8	8
		9	118	445.6	56.9	6
		10	63	449.3	63.3	6
2	5	7	33	342.7	36.2	2
		8	33	368.6	42.6	2
		9	32	395.9	46.2	2
		10	28	402.0	46.0	2
	15	7	52	363.0	40.2	3
		8	52	386.4	46.9	4
		9	51	418.6	50.1	4
		10	42	429.6	56.5	3
	25	7	63	376.2	46.6	4
		8	63	339.4	51.8	1
		9	61	431.6	55.6	5
		10	47	437.4	58.7	4
	35	7	69	384.2	51.6	6
		8	69	407.6	56.4	6
		9	66	437.4	57.7	6
		10	48	439.2	59.4	4

TABLE 8

Reading Total Scores
for Students with Different Numbers of Years
of Title I Eligibility--Lower Grades

Grade	Years of Eligibility	N	$\bar{X}$	S.D.	%ile
4	TOTAL	419	405.3	75.4	40
	0	301	428.9	67.6	53
	1	26	355.6	69.5	19
	2	35	334.2	70.2	13
	3	50	348.0	45.2	17
	4	7	337.7	46.6	14
5	TOTAL	415	448.6	80.9	46
	0	300	474.8	72.2	59
	1	25	406.6	55.7	27
	2	32	372.2	73.7	15
	3	51	375.4	48.9	15
	4	7	355.8	60.2	10
6	TOTAL	415	481.3	82.2	45
	0	298	505.5	77.5	56
	1	25	440.9	50.4	28
	2	35	405.4	71.4	16
	3	50	424.6	48.8	22
	4	7	381.0	54.1	10
7	TOTAL	371	508.1	86.3	42
	0	265	530.7	84.7	52
	1	22	465.6	60.2	25
	2	30	450.9	69.3	19
	3	48	450.8	53.2	19
	4	6	409.2	62.2	9

TABLE 9

Reading Total Scores
for Students with Different Numbers of Years
of Title I Eligibility--Upper Grades

Grade	Years of Eligibility	N	$\bar{X}$	S.D.	%ile
7	TOTAL	327	490.8	94.9	34
	0	190	542.5	74.4	58
	1	67	442.9	64.2	17
	2	49	401.2	67.9	7
	3	17	381.4	80.3	5
	4	4	403.8	25.4	8
8	TOTAL	325	521.6	98.6	36
	0	187	574.8	81.1	58
	1	67	464.9	60.9	16
	2	50	442.4	77.5	12
	3	17	414.3	75.3	7
	4	4	431.2	41.2	9
9	TOTAL	311	554.0	102.3	36
	0	180	604.4	92.1	56
	1	62	500.1	58.0	18
	2	48	477.7	84.5	13
	3	17	455.9	63.5	8
	4	4	455.2	40.3	8
10	TOTAL	94	530.6	118.7	26
	0	27	657.8	116.0	64
	1	20	516.0	78.9	15
	2	29	464.2	65.2	6
	3	14	463.5	71.6	6
	4	4	460.8	34.7	5

TABLE 10

Math Total Scores
for Students with Different Numbers of Years
of Title I Eligibility--Lower Grades

Grade	Years of Eligibility	N	$\bar{X}$	S.D.	%ile
4	TOTAL	418	376.6	54.6	32
	0	302	392.5	51.1	43
	1	26	350.5	41.0	15
	2	34	330.4	41.4	8
	3	49	329.4	28.9	8
	4	7	339.1	73.0	12
5	TOTAL	416	412.0	59.8	33
	0	300	431.5	53.9	44
	1	24	383.8	42.0	18
	2	34	354.6	41.2	9
	3	51	356.5	39.3	9
	4	7	355.7	55.6	9
6	TOTAL	414	444.9	65.0	32
	0	299	461.7	62.8	42
	1	24	416.9	39.5	20
	2	34	410.7	50.6	18
	3	50	391.2	44.8	11
	4	7	376.6	71.7	8
7	TOTAL	371	471.1	72.4	31
	0	265	488.4	72.5	40
	1	22	436.7	50.5	18
	2	30	433.3	58.7	17
	3	48	421.0	42.2	13
	4	6	425.0	82.6	14

TABLE 11

Math Total Scores
for Students with Different Numbers of Years
of Title I Eligibility--Upper Grades

Grade	Years of Eligibility	N	$\bar{X}$	S.D.	%ile
7	TOTAL	327	460.8	77.3	28
	0	190	500.6	65.0	46
	1	67	426.7	53.3	15
	2	49	390.5	51.9	6
	3	17	375.7	59.1	4
	4	4	367.0	10.7	4
8	TOTAL	323	495.5	89.6	29
	0	186	543.2	75.5	49
	1	66	451.5	57.7	15
	2	50	417.6	60.2	8
	3	17	401.2	64.4	6
	4	4	377.2	38.2	3
9	TOTAL	312	528.0	102.2	27
	0	182	578.4	92.5	46
	1	62	475.9	71.4	12
	2	47	445.7	60.2	6
	3	17	433.8	64.5	5
	4	4	411.0	28.4	3
10	TOTAL	93	501.1	100.7	13
	0	26	614.0	79.0	50
	1	19	502.9	72.8	14
	2	30	441.2	56.5	4
	3	14	439.9	73.8	4
	4	4	421.8	20.5	3

TABLE 12

ESS Cutoff Scores*
Used in Selecting Percentile Groups

	GRADE	LEVEL	ESS FOR DESIGNATED PERCENTILE			
			5th	15th	25th	35th
READING	4	1-2	300	342	370	390
	7	3-4	385	335	467	494
MATH	4	1-2	315	349	367	382
	7	3-4	379	427	455	479

*Based on Form Q

APPENDIX A

Plots of Percentile Ranks for Students with Different Years of Title I Eligibility

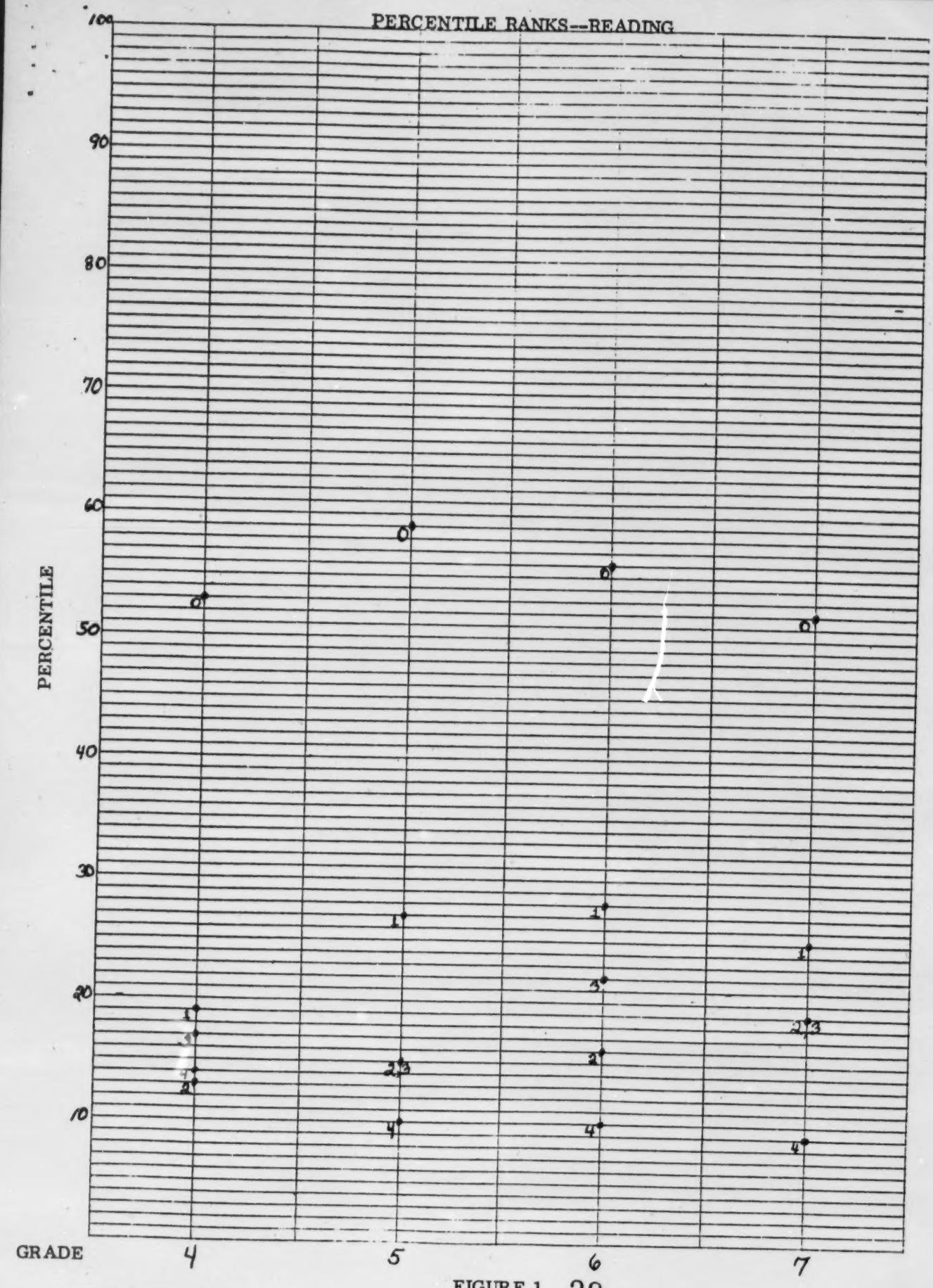
PERCENTILE RANKS--READING
PERCENTILE
100
90
80
70
60
50
40
30
20
10
GRADE
4
5
6
7

FIGURE 1

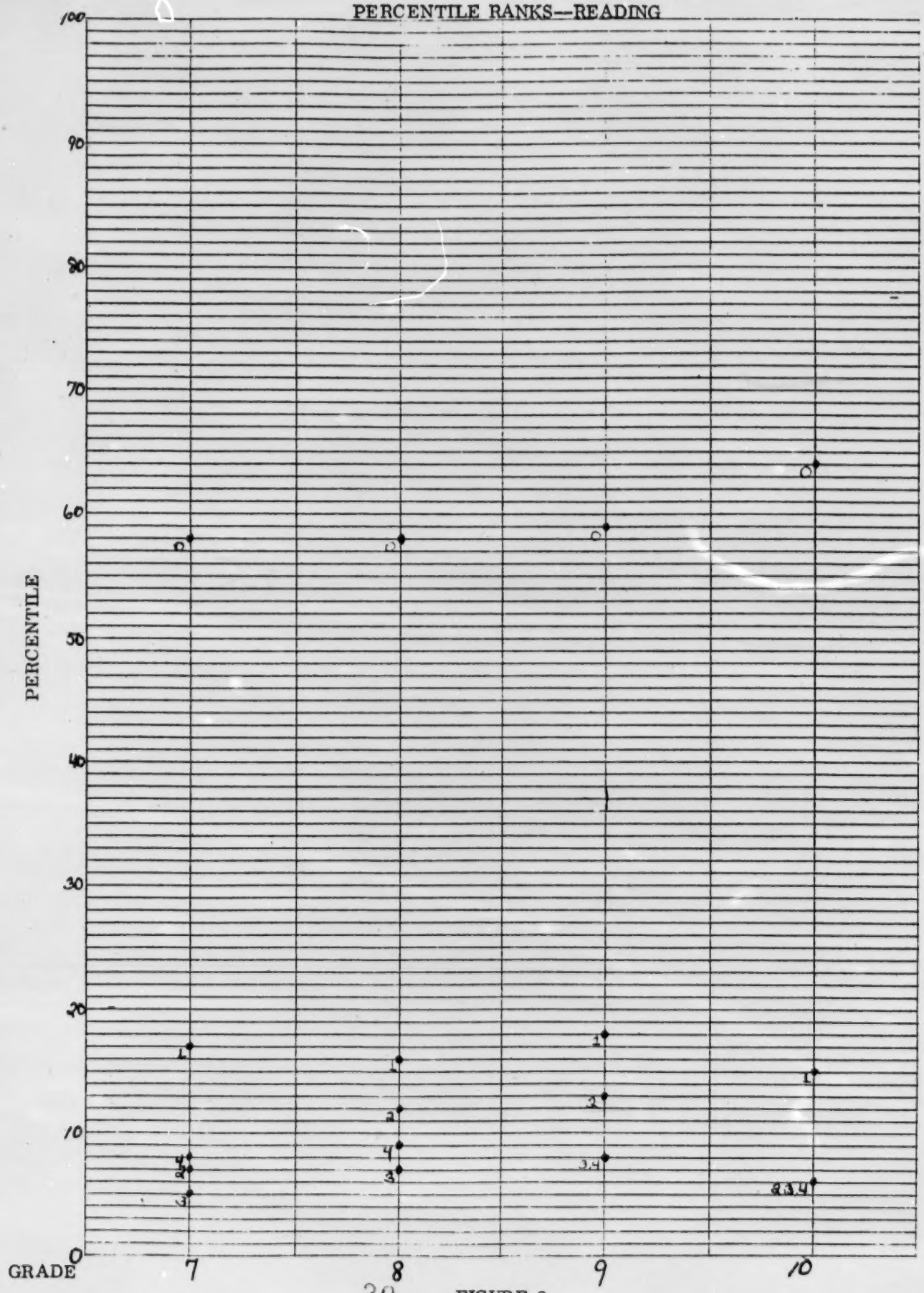
PERCENTILE RANKS--READING
PERCENTILE
100
90
80
70
60
50
40
30
20
10
0
GRADE
7
8
9
10

FIGURE 2

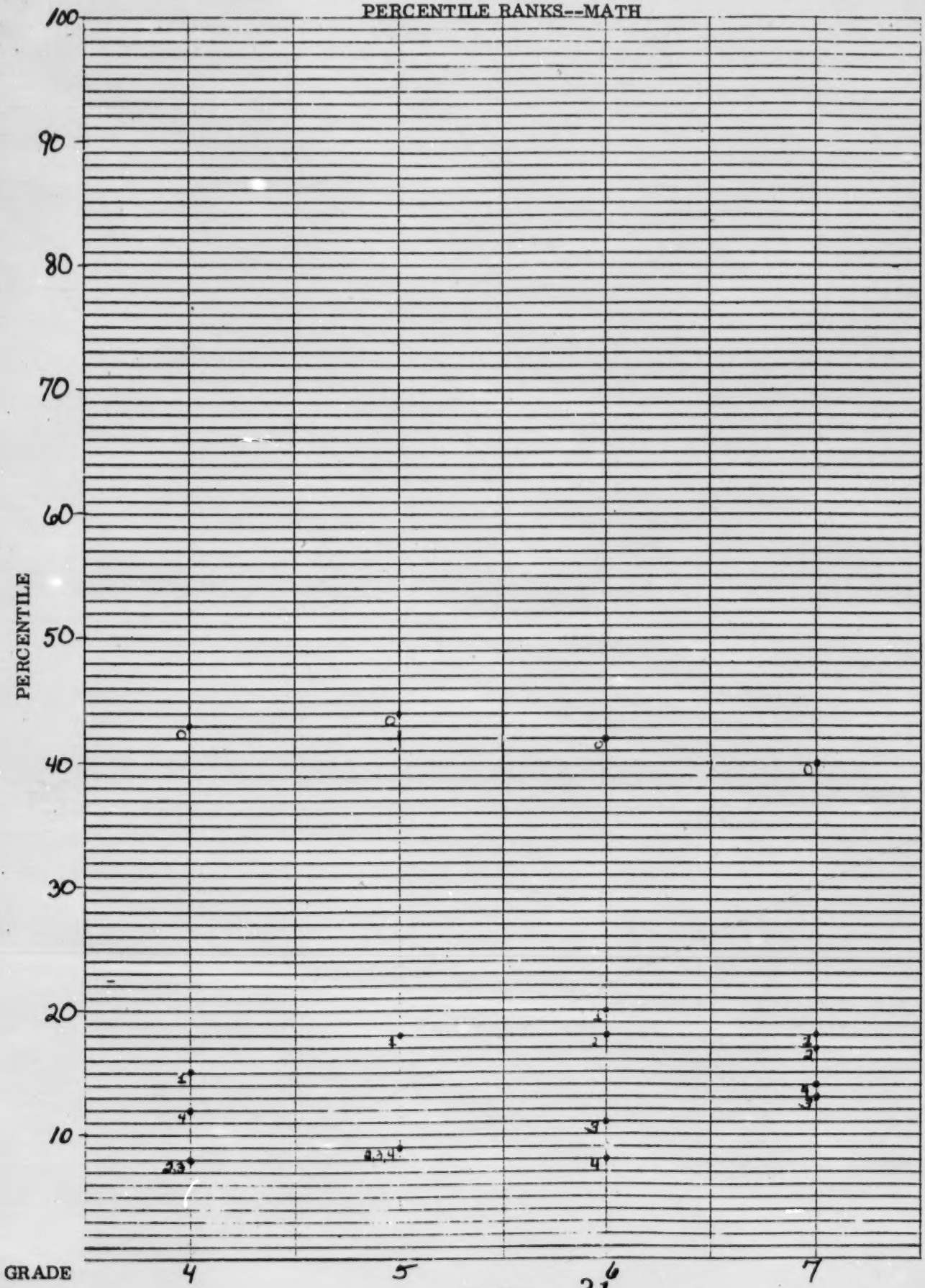
PERCENTILE RANKS--MATH
100
90
80
70
60
50
40
30
20
10
PERCENTILE
GRADE
4
5
6
7

FIGURE 3

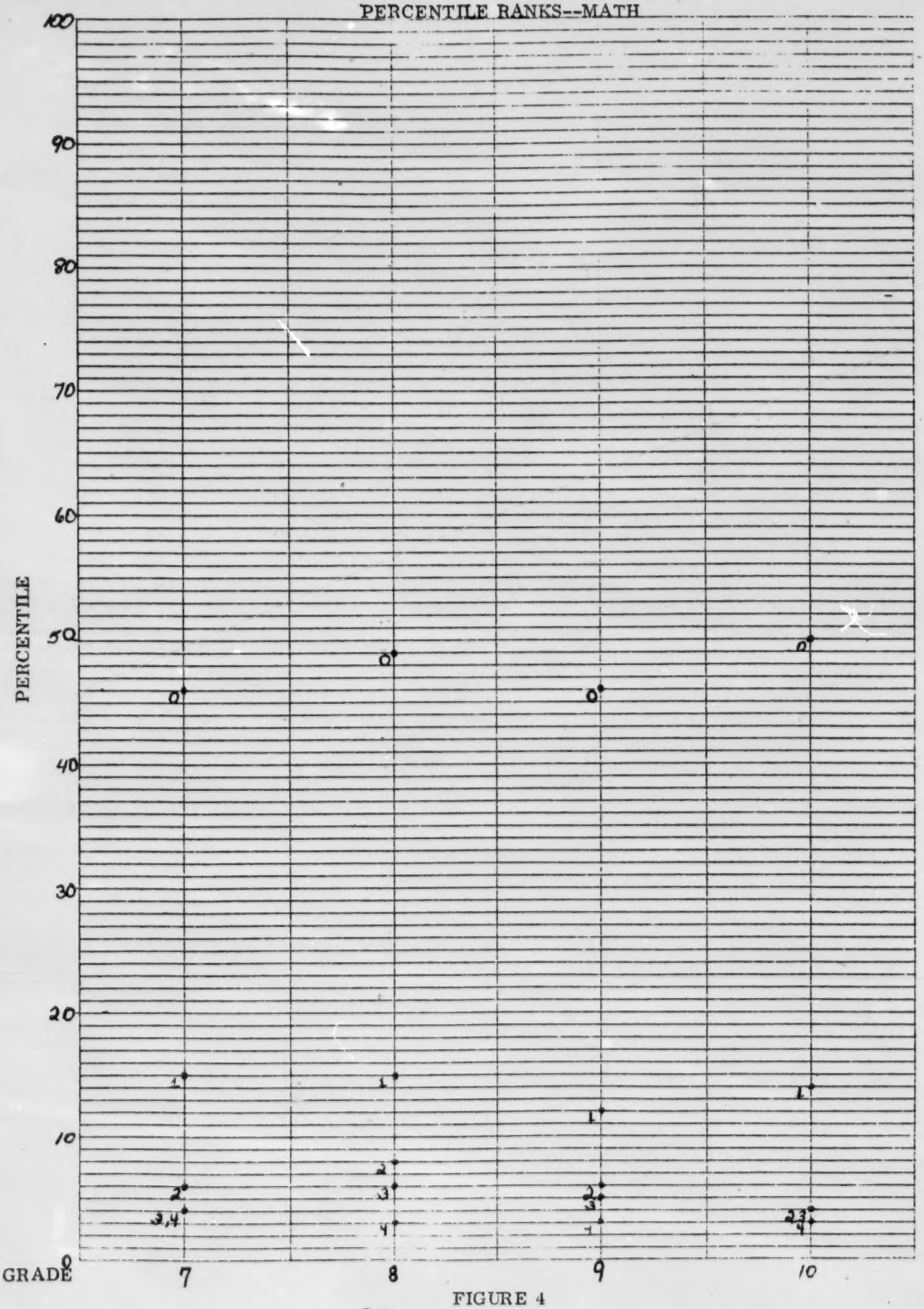
PERCENTILE RANKS--MATH
PERCENTILE
100
90
80
70
60
50
40
30
20
10
0
GRADE
7
8
9
10

FIGURE 4